

Groundwater Data Management

Using Microsoft Access and DirectX Automation
to Create a Groundwater Pseudo-GIS

Douglas Kelly, Hydrogeologist, Island County, WA, Dept. of Environmental Health
Dr. Gordon Eaton, Formerly, Director, U.S. Geological Survey, Camas, WA

Well Coordinates

Latitude: **48° 06' 41"** Longitude: **122° 26' 01"** From TRS: ☐
 M North: **5328612 m** UTM East: **542145 m** From Parcel XY: ☐
 SP North: **409451 ft** SP East: **1609031 ft** From DGPS: ☒

WATER WELL REPORT

Island County, Washington

Site ID: **9FH** Old ID: **2R7**Site Type: **Well**Shore Dist: **2023**Disp: ☒ Ref: ☐

Exit

OWNER: Name: **El Camano Community Club**Address: **2747 Fox Street**City: **Camano Island**State: **WA** Zip: **98292**LOCATION OF WELL: Island: **Camano** T/R-S: **30N/03E-04P** Parcel: **S6545-00-00027 0** Land: **PWS-ID: 22593 P Grp: A Src#: 1**Street Address of Well: **El Camano Water System**Owner: **El Camano Community Clu** PWS Name: **EL CAMANO COMMUNITY C** #Con: **24**

PROPOSED USE:

Parcels Within Specified Range of 30N/03E-04P

TYPE OF WORK:

☒ New
☐ Aban

DIMENSIONS:

CONSTRUCTION

Casing Installed:

Screens:

Sta

Surface seal: Ma

PUMP:

WATER LEVELS:

Available Drawdown

Interval: **1** LevInterval: **1** Lev

WELL TESTS:

Interval: **1** Type: **Pump** Field: **135** gpm Alter: **4** hours Date: **2/18/1970**

Parcel Number: S6545-00-00026-0
 S6545-00-00027-0

Current Owner Information:
 El Camano Community Club
 2746 Fox Street
 Camano Island

Location Address:
 0

TRS: **30N/03E-04P** Land: **1** Unit

Latitude: **48° 06' 41"** Longitude: **122° 26' 02"**

Northings: **409469** Eastings: **1608983**

Build Val: \$0 Assessed: \$7,500

Owner Name Sales History Sale Date

Use Selected Parcel Use TRS Location Cancel Execute Search

1/4 1/2 1 2 CLUB

Search Radius (miles) Owner Info/ History Location Address

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTIONS: **7**

--Top--	BGS	MBL	Thick	Description	USCS Code	--Model--
						Layer Facto
0	156	30	Clayey sand	SC	na	0
30	126	115	Sand, pebble gravel	SW	na	0
145	11	23	Yellow clay	CH	na	0
166	-12	10	Silty ? clay	ML	na	0
178	-22	27	Muddy sand & water	SM	na	0
205	-49	20	Med. sand & water	SP	na	0
225	-69	11	Sand, gravel & water	SW	na	0
236	-80		TD	TD	na	0

Work Completed: **2/18/1970** Max NO3: **0.5** Max CL: **760** Intrusion: **60/95**Water Usage / Meter Readings: **2**

Meter Units:	Reading	Avg Q (gpd)	Date
Gallons	191500		4/19/2002
Scale Factor: 1	1162970	5459.1	8/20/2002
Total Scale: 1			

WELL CONSTRUCTOR CERTIFICATION:

Name: **A. G. Kounkel** Start Card: **DOE-Link:**

Address: **Stanwood, WA 98292** DOE Unique: **AGA711**

Reg Num: **KOUNKWD099KT** Water Right: **G1-10444**

Remarks: **GWMP:C-05. Note: former owner: Art Cook., 2514.**Modified: **1/15/2003 13:19:48**SWI Risk Rating: **High**

Well Coordinates

Latitude: **48° 13' 00"** Longitude: **122° 41' 10"** From TRS: ☐
 TM North: **5340225 m** UTM East: **523317 m** From Parcel XY: ☐
 SP North: **449287 ft** SP East: **1548336 ft** From DGPS: ☒

WATER WELL REPORT

Island County, Washington

Site ID: **BFN** Old ID: **3GO**Site Type: **Well w/in Wellfield**Shore Dist: **1744**Disp: ☒ Ref: ☐

Exit

OWNER: Name: **Coupeville #5- Store - Dean Manor**

Address:

City: **Coupeville**State: **WA** Zip: **98239**LOCATION OF WELL: Island: **Whidbey**T/R-S: **32N/01E-33K**Parcel: **R13233-233-3740**Land: **400 U** PWS-ID: **15550 9** Grp: **A** Src#: **8** **5AR**

Street Address of Well:

Owner: **Town of Coupeville**PWS Name: **COUPEVILLE, TOWN OF**#Con: **872**

PROPOSED USE:

☒ Domestic ☐ Industrial ☐ Municipal ☐ Dewater
☐ Irrigation ☐ Test Well ☐ Other ☐ Anode

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTIONS: **9**

TYPE OF WORK:

Owner's number of well (if more than one): **8**

☒ New Well ☒ Deepened Method: ☐ ☐
☒ Abandoned ☒ Reconditioned ☐ ☐

DIMENSIONS:

Drilled: **270** feet. Depth of C

CONSTRUCTION DETAILS:

Diam. (in)

Casing Installed:

8

Screens: Type Interval Diam. Sl

1 8 0.0

Surface seal: Material:

PUMP:

Type:

WATER LEVELS: **45** Rptd Elev (MSL): ft. Surveyed: ☐ Stickup: ft.Available Drawdown: **160** TD Elev: **-154** WL Elev: **5.9** Calc'd Elev: **114.0** ft.Interval: **1** Level: **102.00** ft. BTOC Date: **1/1/1969** Rem: Interval: **1** Level: **101.00** ft. BTOC Date: **8/15/1969** Rem:

WELL TESTS:

Interval	Type	Yield	Drawdown	After	Date
1		1.65 gpm	1 feet	hours	1/1/1969
1	Pump	gpm	119.3 feet	4 hours	7/2/1981

Water Right Information

ID: G1-20378CWRIS
 Type: Certificate
 Business: Coupeville Town
 GPM: 210
 Acre Feet / Yr: 190 (117.8 gpm continuous)
 Purpose: MU
 Priority Date: 11/20/72
 Acres IRR: 0
 Dom Units: 0
 Source: Well
 TRS: T32N/R01E-33
 Address: Wris Migration - No Address

OK

Cancel

--Top--	BGS	MSL	Thick	Description	USCS Code	--Model-- Layer	Factor
21				Clay	CH	TE	0
67				Hard	CL	na	0
6				Sand	SP	AD	0
116				Clay	CH	TD	0
6				Water sand	SP	AC	0
2				Sandy clay	SC	na	0
18				Fine sand	SP	na	0
31				Water sand	SP	na	0
3				Clay chunks in sand	SC	TC	0
				TD	TD	na	0

8/1/1969 Max NO3: **0.3** Max CL: **105** Intrusion: **1/12**

Water Readings:

Reading Avg Q (gpd) Date

Meter Units: **Gallons**Scale Factor: **1**Total Scale: **1**

WELL CONSTRUCTOR CERTIFICATION:

Name: **Whidbey Drillers**

Start Card:

DOE-Link:

Address: **1143 W. Ft. Nugent Rd, OH, WA 98277**DOE Unique: **AGA993**Reg Num: **WHIDBWD289**Water Right: **G1 20378**

Remarks: **CW-40. Well #5. Six screens total. (see well log). Replaced with Site ID 5AR. JMT 10-2-00**

Modified: **3/21/2003 09:19:35**SWI Risk Rating: **High**

Sample Result: None

Color Codes: Secondary
PrimaryColor indicates at least
ONE sample exceeds the
selected parameters MCL

HYDROGEOLOGIC DATABASE

Groundwater Geochemistry

Owner Name: El Camano Community Club

Site ID: 9FH

Site Type: Well

Intrusion: 60/95

TRS: 30N/03E-04P

OH PWS- ID: 22593

DOH Source #: 1

PWS Name: EL CAMANO COMMUNITY CLUB

Remarks: GWMP:C-05. Note: former owner: Art Cook., 2514.

Graph Scale

Auto

Manual

Sample
Date

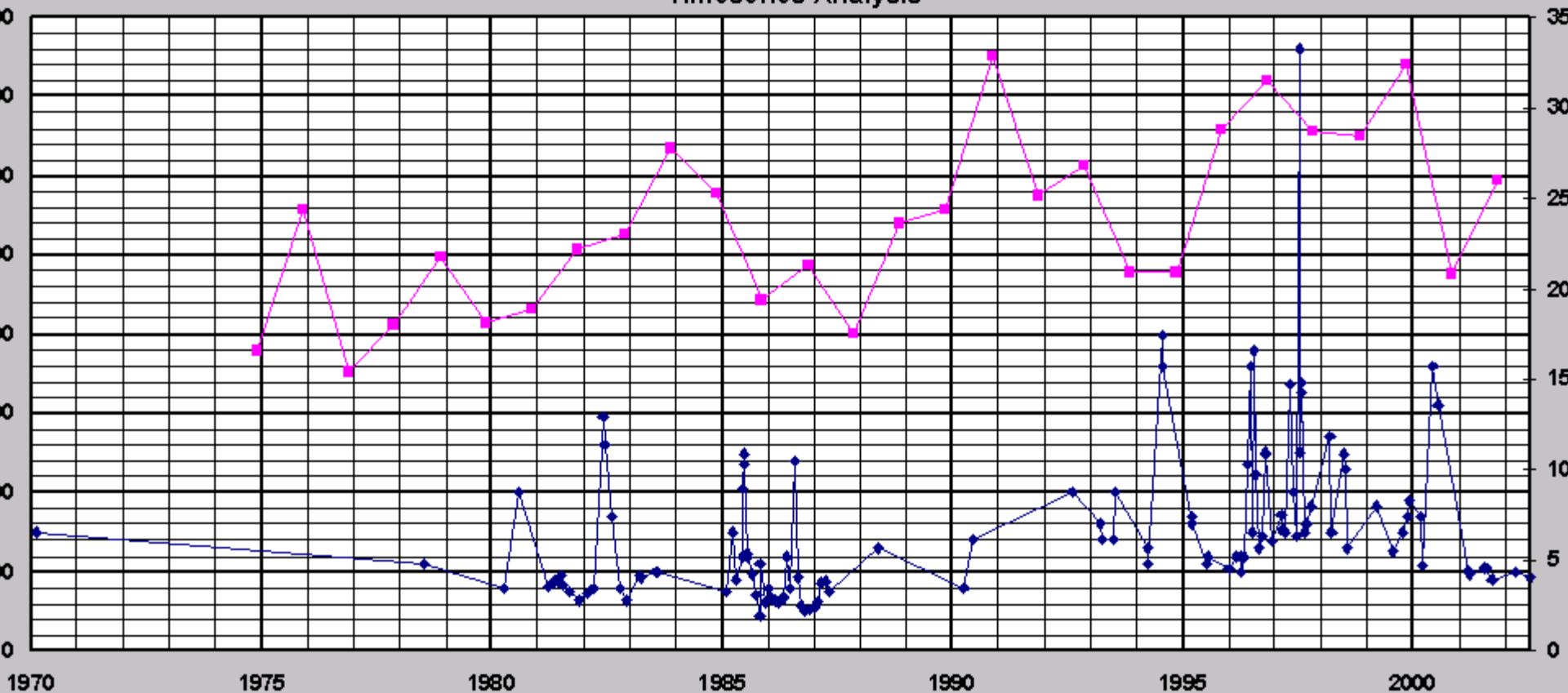
Alk	As	Ag	Ba	Ca	Cd	C1	Color	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Na	NO3	Pb	Se	SO4	TDS	Turbidity	Zn
-----	----	----	----	----	----	----	-------	----	----	---	----	----	---	----	----	----	-----	----	----	-----	-----	-----------	----

Bicarbonate

Conductivity

Hardness

Timeseries Analysis





HYDROGEOLOGIC DATABASE

Seawater Intrusion Analysis

Owner Name: **El Camano Community Club**

TRS: **30N/03E-04P**

Site ID: **9FH**

Site Type: **Well**

DOH PWS- ID: **22593**

DOH Source #: **1**

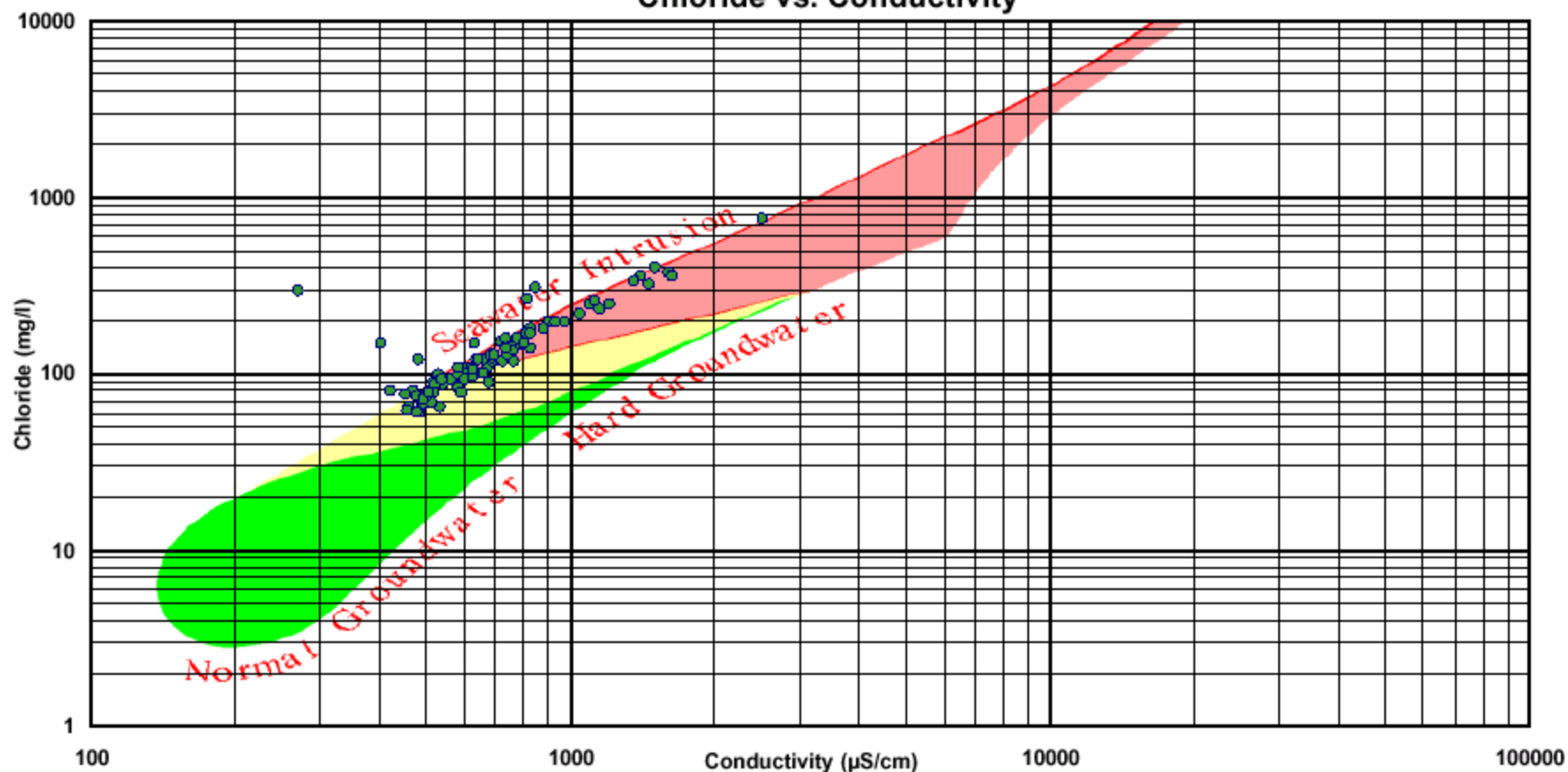
PWS Name: **EL CAMANO COMMUNITY CLUB**

Intrusion

60 of 95 Samples Appear Intruded

Remarks: **GWMP:C-05, Note: former owner: Art Cook., 2514.**

Chloride vs. Conductivity



Disclaimer: Data presented has been collected from a variety of sources. Island County makes no guarantee as to the validity or accuracy of this data.

HYDROGEOLOGIC DATABASE

Seawater Intrusion Analysis

Exit

Owner Name: El Camano Community Club

TRS: 30N/03E-04P

Site ID: 9FH

Site Type: Well

IPWS- ID: 22593

DOH Source #: 1

Remarks: GWMP:C-05. Note: former owner: Art Cook., 2514.



Stiff Diagram of Groundwater Analysis

Sample Date: 7/23/1996 10:00:00

Cations

K+Na

Ca

Mg

Anions

Cl

HCO3

SO4

15

10

5

0

-5

-10

-15

Milliequivalents Per Liter

Charge Balance Calculation

Cations: 13.05454 meq/l

Anions: -13.7588 meq/l

E.N. -2.6 %

Stiff Diagrams for Typical Groundwater Types

K+Na

Ca

Mg

Cl

HCO3

SO4

Normal Dilute Groundwater

K+Na

Ca

Mg

Cl

HCO3

SO4

15

10

5

0

-5

-10

-15

Very Hard Groundwater

K+Na

Ca

Mg

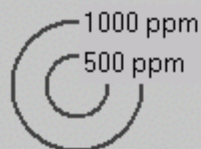
Cl

HCO3

SO4

Seawater Intrusion Influenced Groundwater

Charge Balance Calculation

Cations: **6.822** meq/lAnions: **-7.352** meq/lE.N. **-3.7** %Number Samples. **11**Total Dissolved Solids
(parts per million)

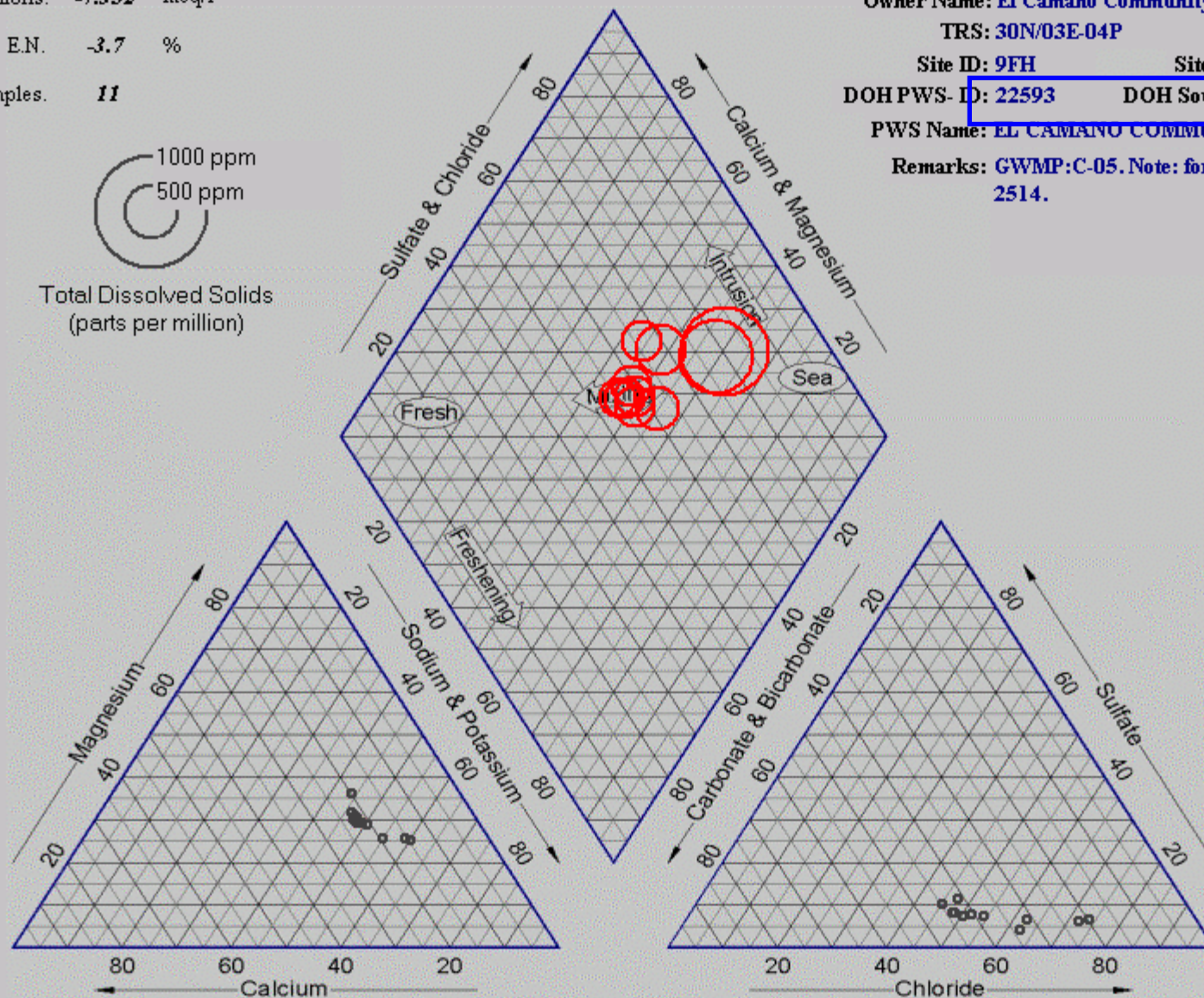
HYDROGEOLOGIC DATABASE Piper Geochemical Analysis

Close



Sampling Data

Calibration Data

Owner Name: **El Camano Community Club**TRS: **30N/03E-04P**Site ID: **9FH**Site Type: **Well**DOH PWS- ID: **22593**DOH Source #: **1**PWS Name: **EL CAMANO COMMUNITY CLUB**Remarks: **GWMP:C-05. Note: former owner: Art Cook.,
2514.**

Cations

Anions

Well Coordinates

Latitude: **48° 06' 41"** Longitude: **122° 26' 01"** From TRS: ☐
 TM North: **5328612 m** UTM East: **542145 m** From Parcel XY: ☐
 SP North: **409451 ft** SP East: **1609031 ft** From DGPS: ☒

WATER WELL REPORT

Island County, Washington

Site ID: **9FH** Old ID: **2R7**Site Type: **Well**Shore Dist: **2023**Disp: ☒ Ref: ☐

Exit

OWNER: Name: **El Camano Community Club**Address: **2747 Fox Street**City: **Camano Island**State: **WA** Zip: **98292**LOCATION OF WELL: Island: **Camano**T/R-S: **30N/03E-04P**Parcel: **S6545-00-00027 0**

Land:

PWS-ID: **22593 P** Grp: **A** Src#: **1**Street Address of Well: **El Camano Water System**Owner: **El Camano Community Clu** PWS Name: **EL CAMANO COMMUNITY C** #Con: **24**

PROPOSED USE:

☒ Domestic ☐ Industrial ☐ Municipal ☐ Dewater
☐ Irrigation ☐ Test Well ☐ Other ☐ Anode

TYPE OF WORK:

Search for Wells Within a User Defined Area

☒ Radius Search

Center Select

Current Well

TRS

Parcel

Parcel Owner

Center
Well # **9FH**

Northing Easting
409451 **1609031**

Radius **2640** Feet
 1/8 1/4 1/2 1 2 5 Miles

☐ Rectangular Search

Circle Map

Northing Easting TRS

Point 1: Point 2: Model Definitions: Recent Searches:

Execute Search

Cancel

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTIONS: **7**

--Top--			Description	USCS Code	--Model-- Layer	Factor
BGS	MSL	Thick				
0	156	30	Clayey sand	SC	na	0
30	126	115	Sand, pebble gravel	SW	na	0
145	11	23	Yellow clay	CH	na	0
168	-12	10	Silty ? clay	ML	na	0
178	-22	27	Muddy sand & water	SM	na	0
205	-49	20	Med. sand & water	SP	na	0
225	-69	11	Sand, gravel & water	SW	na	0
236	-80		TD	TD	na	0

Number of well (if more than one): **1**

Method: ☐ Rotary ☐ Bored ☐ Jetted
☒ Cable ☐ Driven ☐ Dug

Diameter of Well: **6** in.Depth of Completed Well: **236** ft.

Diam. (in) from to (ft BGS)

6 -2.25 236

Interval Diam Slot (in) From To (bgs/msl)

1 0.200 226/-70 236/-80

To depth: **15** ft.Horsepower: **5**155 ft. Surveyed: ☐ Stickup: **2.3** ft.WL Elev: **2.9** Calc'd Elev: **156.0** ft.8/26/1992 14:00:00 Rem: 4/19/1993 14:15:00 Rem:

After Date

4 hours 2/18/1970

Work Completed: **2/18/1970** Max NO3: **0.5** Max CL: **760** Intrusion: **60/95**Water Usage / Meter Readings: **2**Meter Units: **Gallons**Scale Factor: **1**Total Scale: **1**

Reading Avg Q (gpd) Date

491500 4/19/2002

1162970 5459.1 8/20/2002

WELL CONSTRUCTOR CERTIFICATION:

Name: **A. G. Kounkel**Address: **Stanwood, WA 98292**Reg Num: **KOUNKWD099KT**

Start Card:

DOE-Link:

DOE Unique: **AGA711**Water Right: **G1-10444**Remarks: **GWMP:C-05. Note: former owner: Art Cook., 2514.**Modified: **3/31/2003 11:06:56**SWI Risk Rating: **High**

HYDROGEOLOGIC DATABASE
Regional Seawater Intrusion Analysis
Circular Search
PWS22593

Total Depth Elevation is

- Above Sea Level > +30 ft MSL
- Near Sea Level +30 ft to -30
- Below Sea Level < -30 ft MSL
- Unknown Depth

Center = Well # 9FH
Radius = 1/2 Mile

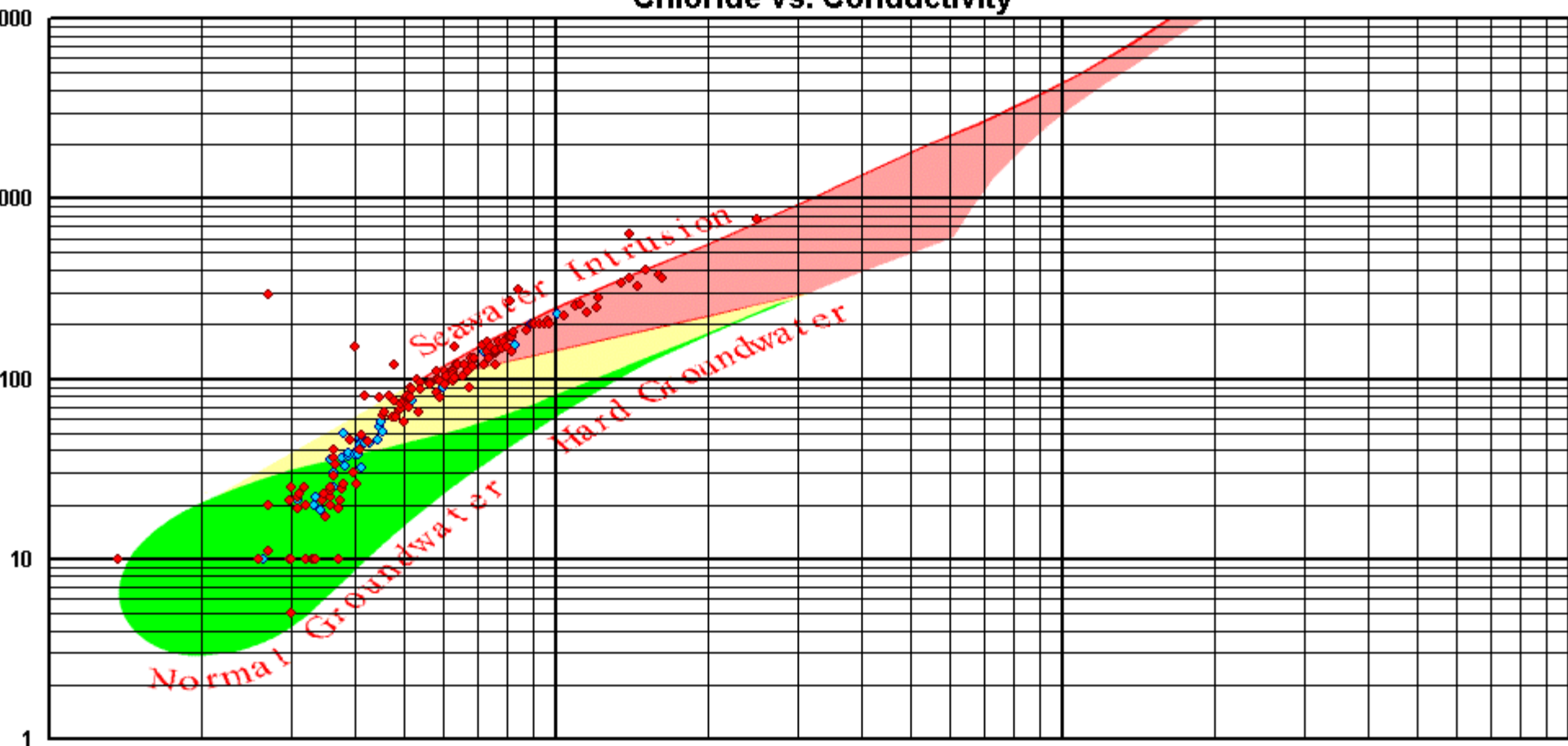
View

Wells, Wells w/in
WellFields, WellFields.

Intrusion

Seawater Intrusion Rating 'High' Risk
69 of 179 Samples Appear Intruded

Chloride vs. Conductivity



HYDROGEOLOGIC DATABASE

Geochemistry Database
Regional Search
Center = Well# 9FH
Radius = 1/2 Mile

View
Wells, Wells w/in
WellFields, Wellfields.

SiteID: 9FR Owner: John Henning Distance from Center: 1235

Chemistry Data

Date	Alk	As	Ag	Ba	Bicarbonate	Ca	Cl	Cl	Color	Conductivity	Cr	Cu	F	Fe	Hg	Hardness	K	Mg	Mn	Na	NO3	Pb	Se	SO4	TDS	Turbidity	Zn
<u>Water Level Data</u>																											
Date: 10/3/199 Dtw: 229																											

SiteID: 9FA Owner: Mike Rosenbach/Ken Sedy Distance from Center: 1305

Chemistry Data

Date	Alk	As	Ag	Ba	Bicarbonate	Ca	Cl	Cl	Color	Conductivity	Cr	Cu	F	Fe	Hg	Hardness	K	Mg	Mn	Na	NO3	Pb	Se	SO4	TDS	Turbidity	Zn
I 9/14/2001								21		344																	
I 10/20/1998								34		345											<0.5						
I 7/14/1993								70.5		507											<0.5						
I 4/24/1998		.005	<.01	.015			<.002		<.5		<.01	<.02	0.3	0.14	<.0005					123	159	<.002	<.005	13.7	242	0.9	<.05

Water Level Data

Date: 7/10/199 Dtw: 187 | Date: 10/12/19 Dtw: 187

SiteID: 9G6 Owner: Maris Petersons Distance from Center: 1310

Chemistry Data

Date	Alk	As	Ag	Ba	Bicarbonate	Ca	Cl	Cl	Color	Conductivity	Cr	Cu	F	Fe	Hg	Hardness	K	Mg	Mn	Na	NO3	Pb	Se	SO4	TDS	Turbidity	Zn
I 12/4/1990								17		330											2						

Water Level Data

Date: 10/3/199 Dtw: 210

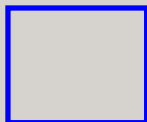
SiteID: 9E7 Owner: Vito Monni Distance from Center: 1339

Chemistry Data

Date	Alk	As	Ag	Ba	Bicarbonate	Ca	Cl	Cl	Color	Conductivity	Cr	Cu	F	Fe	Hg	Hardness	K	Mg	Mn	Na	NO3	Pb	Se	SO4	TDS	Turbidity	Zn	
I 7/29/1991								21																				
I 7/29/1991								17																				
I 7/29/1991								17																				
I 7/22/1991	<.010	<.010	<.25				<.002	19	<.5	310	<.010	<.1	2	.05	<.0010	130				200	14	<.2	.009	<.005	<.10		.7	2

Water Level Data

Date: 6/3/1991 Dtw: 120.6 | Date: 7/31/199 Dtw: 120



AutoCAD 14

Hydrogeologic Database Map Generation Utility

Wells		Roads	Contours / Features	Other
<input type="radio"/> Well Location / MapCode		ID		
<input type="radio"/> 1/2 Mile Radius (Chloride)		Max NO3 ⊕ Max Cl		
<input type="radio"/> Stiff Diagrams		TdElev		
Symbol Scale: 1 x				
<input type="radio"/> Param1	NitrateNO3	Avg	Max	
<input type="radio"/> Param2	Chloride	Avg	Max	
<input type="radio"/> Param3	Sodium	Avg	Max	
	Sulfate			
	TDS			
	Total Depth Elev.			
	Turbidity			
	Water System Name			
	Well Depth			
	Zinc			
8.5 x 11		Vector		
c:\My Documents\Acad\PWS22593				
Internal		External	Temporary	Normal
Build Map		Cancel		

Island County
Hydrogeologic Database
Well Locations
Circular Search

Center = Well#9FH

Radius = 1Mile

Name: PWS22593.dwg

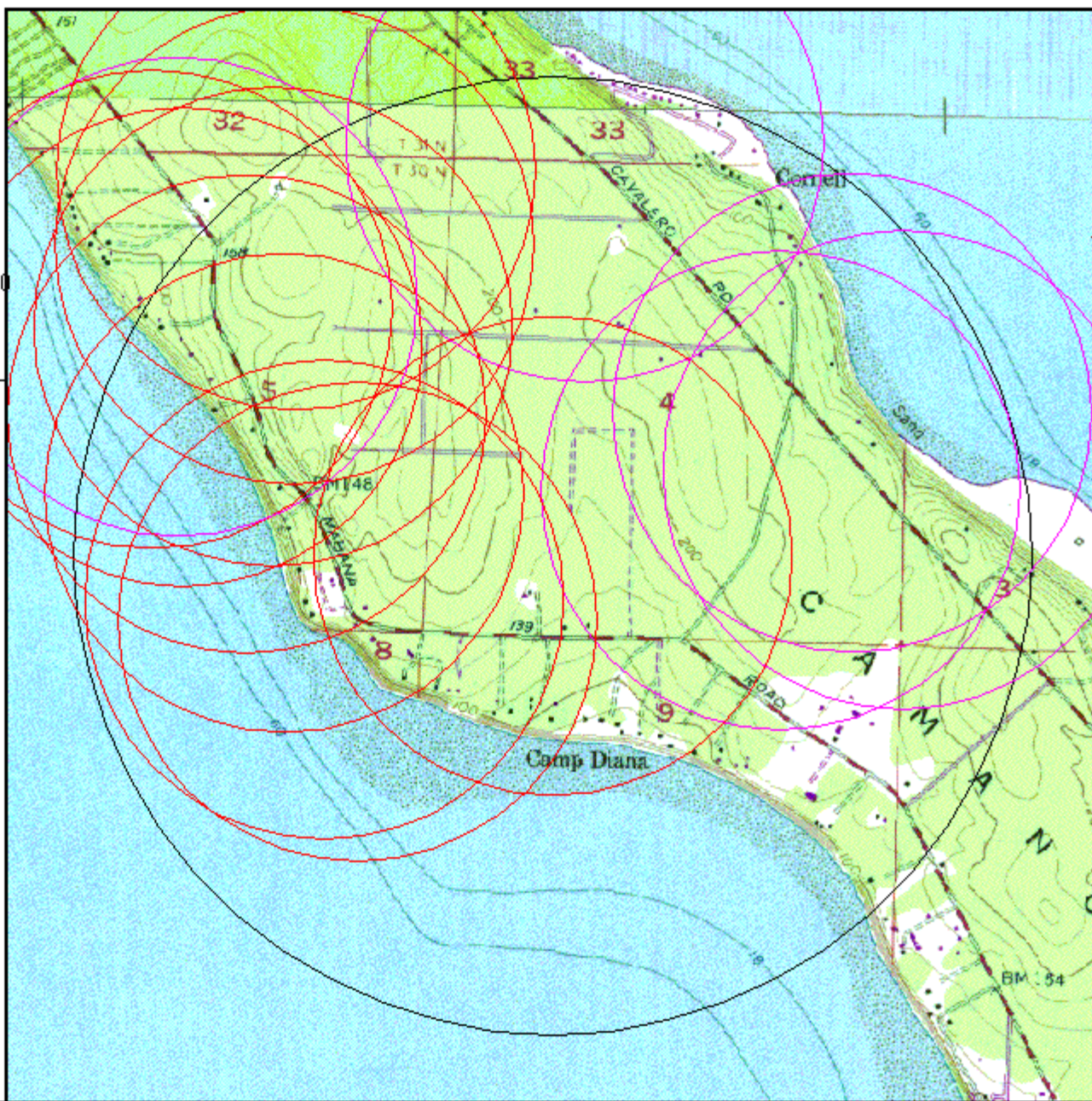
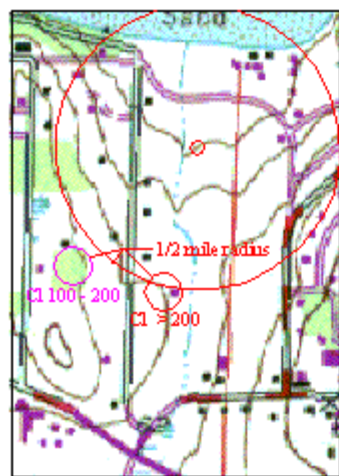
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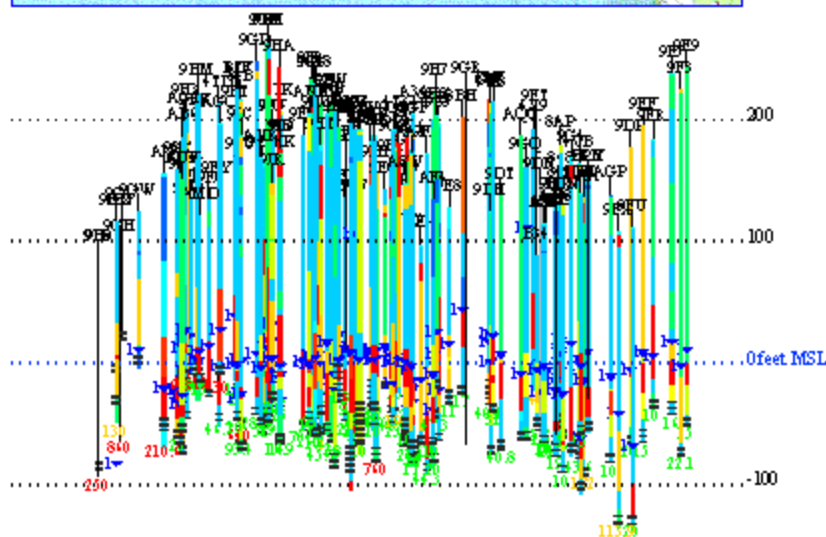
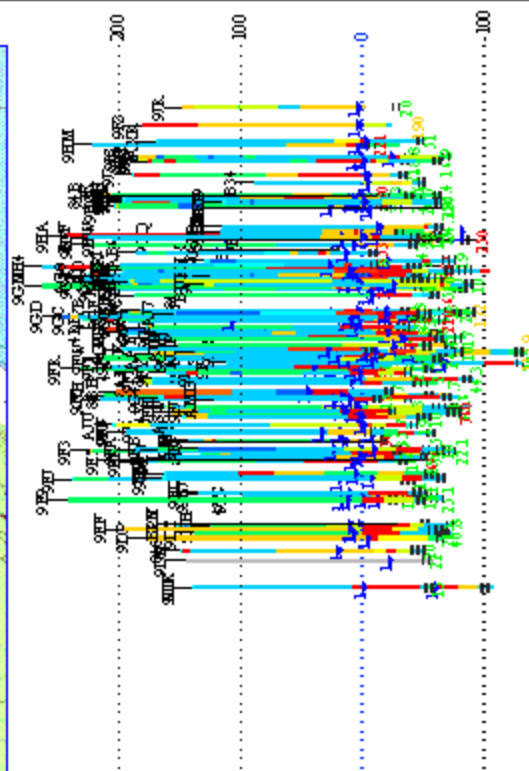
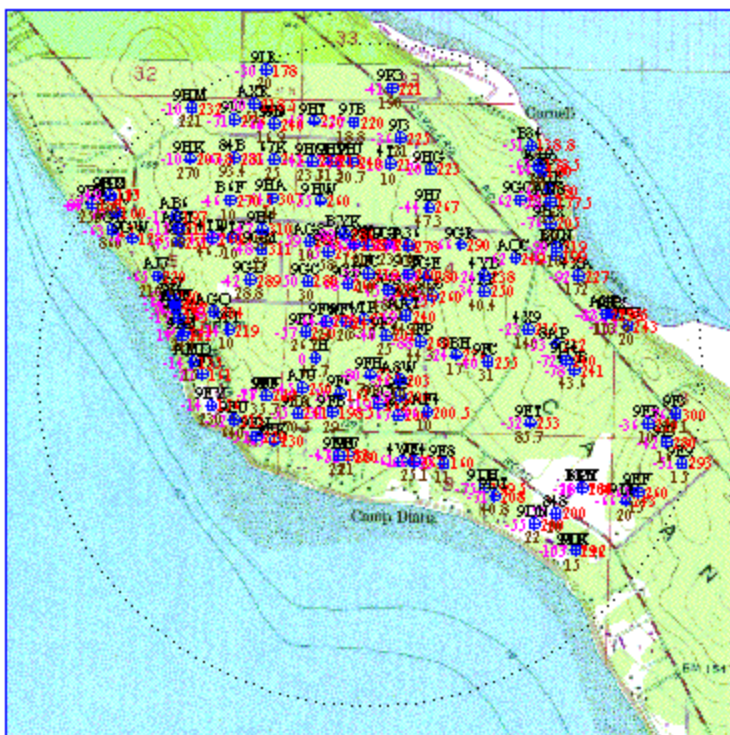
Date: 3/31/2003 12:00:57

0 600 1800 3000

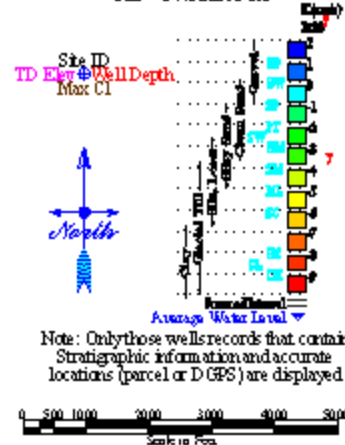
Scale in Feet

Legend





Island County Hydro Geology
Stratigraphic Analysis
Center = 1809031.409451
Radius = 5280 ft
File = PWS22593.XS



View Stratigraphy and Edit Model Layer Picks

☐ Radius Search

Center Select

Selected Well

Center:

Well # 364

TRS

Using a Groundwater Database to Generate 3D Groundwater Flow Models

☐ Rectangular Search

Northing

Easting

TRS

Point 1:

438340

1543052

Point 2:

439660

1574028

☐ Scroll Search

Scan Height

1320

Ft

Vertical

Horizontal

View / Edit Stratigraphy

Cancel

Well Coordinates

Latitude: 48° 10' 41" Longitude: 122° 35' 22" From TDS
TM North: 5335961 m UTM East: 5
SP North: 434633 ft SP East: 1

OWNER: Name: Van Kellems

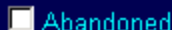
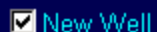
LOCATION OF WELL: Island: V

Street Address of Well: 879 S.

PROPOSED USE:



TYPE OF WORK:



DIMENSIONS:

Drilled:

CONSTRUCTION DETAILS:

Casing Installed:

Screens: Type

▶ Stainless Steel

Surface seal: Material:

PUMP:

Type:

WATER LEVELS:

Rptd E

Available Drawdown:

TD Ele

WELL TESTS:

Interval Type Yield

▶ 1 Bailer 20 gpd

WATER WELL REPORT
County, Washington

Site ID: 33D

Old ID:

Site Type: Well

Shore Dist: 1297

Exit



Disp: ☒ Ref: ☐

Race Road

City: Coupeville

State: WA Zip: 98239

R23117-420-0800

Land: 10.86 PWS-ID:

Grp:

Src#:

#Con:

Van G Kellems

PWS Name:

#Con:

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTIONS: 7

	--Top--	BGS	MSL	Thick	Description	USCS	--Model--
						Code	Layer Factor
▶	0	194	9	Hardpan	CL	GD	0
	9	185	19	Sandy clay	SC	AE	0
	28	166	90	Hardpan	CL	TE	0
	118	76	10	Sandy clay	SC	na	0
	128	66	37	Dirty sand	SC	AD	0
	163	29	102	Hard - gravelly hardpan	CL	TD	0
	267	-73	11	Water in gravel	GP	AC	0
	279	-84		TD	TD	na	0

Work Completed: 10/11/1996 Max NO3: Max CL: Intrusion: 0/0

Water Usage / Meter Readings:

Reading Avg Q (gpd) Date

Meter Units: Gallons

Scale Factor: 1

Total Scale: 1

WELL CONSTRUCTOR CERTIFICATION:

Name: Whidbey Drillers

Start Card: 054150

DOE-Link:

Address: 1143 W. Ft. Nugent Rd, OH, WA 98277

DOE Unique:

Reg Num: WHIDBWD289

Water Right:

Remarks:

Modified: 5/5/1999 08:06:09

SWI Risk Rating: Medium

